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From Bank Teller to Office Worker : The Pursuit of Systems Designed for People in Practice and Research

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ABSTRACT

This paper describes how the author first became interested in, and identified with, helping users to play a major role in the design of their own computer-based work systems. It discusses some of the problems associated with a participative approach and sets out in detail a new approach to research that can assist our knowledge of how to design for people.

'A thousand mile journey starts with a single step'
Chinese Proverb

This paper will describe how the author became interested in assisting users to play a major role in the design of their own technical and organizational systems and the kind of research which she believes now needs to take place to achieve 'systems designed for people' in the future.

EARLY DOUBTS AND UNCERTAINTIES

My introduction to office automation began about twenty-five years ago when the first office systems were being introduced into European companies. I was then a researcher in Liverpool University, England, and I and my research colleagues were asked to participate in a European project to find out how these strange new machines altered people's jobs and attitudes to work. Most of our carefully formulated hypotheses turned out to be wrong. These early machines did not have much impact on work but a very interesting observation did emerge from the research. This was that firms in all the European countries associated with the project had great difficulty in getting the change introduced and accepted. And so I became very interested in the 'management of change.'

Several projects later on I became unhappy with the traditional academic research role of **observing, documenting** and writing reports that few managers wanted to read. It seemed important to contribute in a more active way. And so I became associated with what today is called **action research**. The researcher still observes, documents and writes reports but she or he also identified problems, gives advice and contributes to the smooth running of the change processes.

Most of the help I offered at this time was concerned with improving communication and consultation between computer technologists and users. So that the complaint "*they never told me anything*" should be heard less often. Then, one day, I suddenly realised that what I was doing was enabling some very badly designed systems to be introduced more easily than would otherwise have been the case. Many of these systems were technically bad, they were almost all bad in human terms. They made work more routine, they increased controls, they forced many office workers, usually women, to spend all day inputing data into unfriendly machines.

It was at this point that I became interested in systems design and in the design of that part of the system that technical systems designers seemed to neglect—the organization of work and the design of individual jobs. It seemed to me that technology should enhance work and make it more, rather than less, satisfying and interesting. I have been trying to get this message across ever since.

STARTING THE JOURNEY—THE QUEST FOR A NEW APPROACH TO SYSTEMS DESIGN

Soon after I started on my quest for a more humanistic systems design I became convinced that the best way of achieving this was to involve office workers in the design of the systems which they would eventually use. Like many good ideas this realization did not occur through a flash of intellect but as a result of an experience. A group

of clerks showed me that they were perfectly capable of making a major contribution to the design of a new system for a sales department.

This event occurred in 1972 in a British firm called Turners Asbestos Cement which produced plastics and asbestos products for the building industry. TAC had a history of successfully introduced computer applications handled by a progressively minded systems group. One of these applications was a batch computer system in the Sales Order Department and a decision was taken to change this to a terminal based on-line system. Although batch computer systems were common in Britain at this time, the TAC systems team recognized that the original system had produced only limited gains in efficiency and had led to some undesirable human consequences which had reduced clerical job satisfaction.[1]

The TAC systems group was anxious for its new on-line system to increase both performance and job satisfaction and it asked me to help create a new work structure that would fit with the requirements of the computer while increasing the quality of working life and job satisfaction of the different clerical groups in the department. At the time I had been developing a method for analyzing and measuring job satisfaction and so I asked the clerks to complete a questionnaire. I also asked them to think about how the work of the department could be redesigned to remove routine.

The information from the questionnaires was used by the system designers to create what they believed to be an efficient and satisfying organizational environment for the on-line system. They arranged a meeting with the sales clerks, described their user friendly system, and then waited for the applause. To their astonishment, the clerks who had listened politely to the proposal, now produced their own blue print for the reorganization of the office. Instead of the conservative changes proposed by the systems designers, they suggested that the existing division between data input clerks and sales clerks should be removed; that the department should be split up into a number of work groups, each assuming responsibility for a specific group of customers, and that the data input tasks and the handling of customer orders, queries and problems should be shared out amongst each of the customer-based work groups. New and inexperienced clerks would deal with simple queries and problems, but as their knowledge and experience increased so they would take responsibility for a larger number of complex problem-solving tasks. The TAC system team, being both forward looking and democratic, recognized the advantages of the clerks' proposal and it was this that was implemented.

The clerks had created for themselves a work structure that today we would call semi-autonomous of self-managing. This kind of structure is recognized by job design experts as contributing to high efficiency and job satisfaction. More importantly, they had grasped the opportunity presented by the job satisfaction survey and invitation to think about job design and assumed responsibility for the design of their own work system.

This initiative persuaded me that other users could and should be helped to assume a design role. Therefore a systematic methodology that enabled users to contribute to the design task needed to be developed. This must be associated with participative structures that brought users and technologists together on equal terms so that technical and organizational design decisions could be shared. This methodology now exists and, thirteen years after TAC, experience in many firms has convinced me that user involvement in systems design produces good systems, high efficiency and high job satisfaction.[2]

PROGRESS AND PROBLEMS ALONG THE ROUTE

Looking back as a researcher at my experiences in helping users to contribute to systems design processes, it is interesting to identify past problems and important to think about present and future problems and needs. Let me describe those I have encountered and predict those that are yet to come.

PAST PROBLEMS

Past problems have been of two kinds—getting user involvement accepted and seen as legitimate by companies and managing participation within the firm.

The first problem is a puzzling one. User involvement does work, it produces good systems that users like, well designed jobs, improved efficiency, user motivation and increased job satisfaction. Even more important it enables users to become expert in managing their own change. Why then, do more firms not use it? Many, when asked, will claim that they do but they then go on to describe a very low level of participation that is more akin to consultation than joint problem solving. In some firms user management is considerably involved in systems design but decisions are not shared with those lower down the department hierarchy. Yet it is here that the most valuable knowledge on how efficiency can be improved is often locatead.

The reasons for this lack of enthusiasm may lie deep in our culture. There are the managers and the managed and firms do not want to disturb this clear relationship by confusing the two roles. Some groups do things, others have things done to them or are told to do things. This produces order if not progress. An interesting point here is

that firms that are very democratic in their normal management processes—they may have good systems of joint consultation and use quality circles—often do not associate these with the design and introduction of computer systems. These are seen as *separate* and *different*.

Another factor inhibiting serious user involvement may be the attitudes of the technologists. They have always seen themselves, and been seen, as the designers, and understandably many may not wish to change this role to one of teaching others how to design. But increasingly it is becoming difficult to exclude users from design and perhaps dangerous to do so. Clerks, perhaps, can always be kept out although there may be high costs in doing this. But I have seen two major systems flounder in recent months because the top management users could not be persuaded, or were not asked, to give serious thought to the questions they wanted the systems to answer.

User involvement of a serious kind therefore requires a change of values, a willingness to share decision taking to regard the knowledge which users possess as important to good systems design. It also requires the commitment of top management to a philosophy of participation. At present, we find examples of participative design in many firms, but not many where this approach has become the standard way of designing new systems.

Problems within a company aiming at high user involvement are less difficult. They include: setting up representative design groups, creating situations where every member of a department can contribute in some way to the design task, developing solutions that meet the needs of different users and of management. Anyone acting in a facilitator role will have to help the design group she is working with to overcome these problems.

PRESENT PROBLEMS

These are related to the new kinds of technology that we are now encountering and to the speed with which it is developing. Organizational design now has to be associated with telecommunications, with expert systems and with the use of voice as well as keyboard. Work groups whose members are physically located at considerable distances from each other are now possible. A variety of things from teaching to decision-taking can now be done electronically. User involvement in systems design is still important, even essential, but it now involves more than bringing a group of clerks together to discuss simple office technology and agree a new form of work organization.

There is now a need to build new organizational structures to fit the new kind of world that we are creating. We know that these structures must fit with our values. They must be humanistic and enhance, not degrade, the work and life environment. They must enable us to do things better: to learn more easily, respond more effectively, take wiser decisions, plan for a desired and desirable future and behave more democratically.

Our problem is that we do not yet know what these structures are or understand their nature. This leads me to the second part of this paper which is a plea for more, better and different research. The management of change has always required knowledge and user involvement in design and has, in the past, required some understanding of the available organizational options. We now no longer know what these are. How can we find out?

CHASING THE FUTURE—THE CONTRIBUTION OF RESEARCH TO PEOPLE-ORIENTED SYSTEMS DESIGN

Is it possible to make suggestions on what research needs to be undertaken to address the new problems of people, using technology, in organizations? Let us use a systems approach to try and solve this problem. We can do this by asking a number of questions. The first is:

1. What is our research mission. Why do behavioral and information scientists wish to study new technology?

We need a statement of values and intentions to answer this question; if possible, one which most researchers will agree with. Here is a suggestion:

> Our research mission is to contribute to knowledge. We hope by contributing to knowledge to enable our countries to become more prosperous and our citizens to have a high quality environment and personal satisfaction in every aspect of their lives. We see appropriate information technology as one important means for achieving this objective.

The second question that follows from this is,

2. Given this mission what kind of research needs to be undertaken to achieve it? In other words what are our key tasks as researchers?

Here are some key tasks:

a. To aim to obtain as good an understanding as is possible of the **total** situation in which the introduction of new technology takes place. How decisions to invest in new technology are taken, who takes them, who is affected, in what way, what are the consequences. Also, what happens to companies which do not invest in new technology?

How are they affected by the innovation strategies of competitors?

b. To obtain an understanding of the **processes** of change. How communities, organizations, groups and individuals can be changed from one socio-technical state to another without experiencing excessive and dysfunctional stress and trauma.

c. To obtain an understanding of how human systems, incorporating new technology, can be **designed** so as to enable them to achieve their chosen missions and goals more efficiently and effectively, while at the same time providing a higher quality of work and non-work life, and greater satisfaction.

d. To obtain an understanding of how viable human systems, once designed, can maintain their viability by **adapting** easily and effectively to changing external and internal environments.

When research objectives and key tasks are defined in this way, one of the dilemmas of this kind of research becomes apparent. All statements, except the first, have normative objectives attached to them. This leads us into a debate about the role in which the sole objective is contributing to knowledge, or should the researcher be attempting to contribute to knowledge with some particular objectives in view. This decision must be up to the individual researcher. Funding bodies, however, must have clear objectives if they are to make choices between competing research applications. It is suggested here that these objectives should not be related solely to pleasing governments but also to an ethical vision of how society can be improved. Given that resources are scarce, and likely to be so for some time, the question for the funding bodies must be "How can we achieve maximum benefits for minimum costs?" The German 'humanization of work' program has taken this stance. Under the heading "Application of new technologies in accordance with human needs," it is stated:

> Humanization projects aim to test and draft model solutions for incorporating new technologies . . . . pilot projects will demonstrate how the margins for organizational planning can be so utilized that the working conditions of those affected are improved as a result.[3]

If these key research tasks are seen as acceptable and worthwhile, and of course they may not be, then the next question is:

3. What is involved in achieving them and what are the problems and constraints that may make achievement difficult?

Let us consider each one in turn in terms of approach, resources, relationships and problems.

UNDERSTANDING THE "TOTAL" SITUATION

A great deal of research to date has tackled partial problems or addressed single variables. Studies have been made, for example, of the impact of computers on the work of clerks, or the way change has been resisted by certain groups of workers. These studies have been useful, but perhaps not as useful as more comprehensive studies would have been. They suffer from the defect of assuming that there are powerful relationships between variables because these are the only variables that have been examined.

Pettigrew has made a plea for what he calls a contextualist approach to research. He says,

> One of the core requirements of a contextualist analysis is the requirement to understand the emergent, situational, and wholistic features of an organism or a process in its context, rather than to divide the world into limited sets of dependent and independent variables isolated from their context.[4]

This approach although important, and neglected in the research fashions of recent years, is not new. In 1927 Mary Parker Follett was saying:

> All industrial psychologists feel that Dr. Mayo has added a very valuable contribution to their work by his insistence on the 'total' situation. And we must remember that we should always mean by that not only trying to see every factor that influences the situation, but even more than that the relations of these factors to one another.[5]

If the **total** situation is not examined then, the writer would argue, misleading conclusions are often drawn. For example, **impact research** in which attempts are made to identify the impact of a particular factor such as technology, tends to make the assumption that there is a direct relationship between technology and perceived consequences. The reality may be that technology is merely an intervening variable between the design philosophy of a technical group and the experience of the group being studied.

If it is accepted that there is a need to study 'total' situations and carry out contextualist research, how can this be done? One way is through **applications** research in which the introduction of a particular application of technology is studied in all its aspects, including all the contextual variables that surround and influence it. This has

certain implications for the way in which the research is organized and carried out. Ideally, it requires an interdisciplinary team which includes engineers or systems designers as well as social scientists. The lone researcher can handle small systems but large systems will require greater resources. There is also a need to involve in the research those individuals and groups who are participating in the change processes. It is they who have the most intimate knowledge of events, relationships and internal politics. Their explanations and analysis will be invaluable in providing the researchers with an understanding of the dynamics of the research situation.

Objections to this **applications** centered research are likely to be that it produces yet another set of case studies from which generalizations cannot be drawn and that it relies on qualitative data and rejects quantification. The reply to the first criticism is that case studies are of immense value in that they can show the relationships between variables and they can also assist the development of theoretical models for testing in other situations. Some generalizations can be made from a series of case studies although researchers experienced in investigating 'total' situations become increasingly aware of the uniqueness of each one of these. Attitudes and behavior are not the result of single variables but of the manner in which a complex network of variables mesh together and interact with each other. Also, case studies do not need to be of single plants, they can be of industries and communities.

The answer to the second objection is that it is not true. Most researchers involved in contextualist research take a contingent approach and use the methods that will best provide meaningful data. Sometimes these will be qualitative, sometimes quantitative.

UNDERSTANDING THE PROCESSES OF CHANGE

This research area has attracted a great deal of interest in the past, primarily from American social psychologists such as Schein and Bennis, although more recently British sociologists, in particular, Pettigrew, have made major contributions. Efforts have been directed at developing a *theory of changing* although with only limited success. We are now concerned not only with understanding the nature of the key variables which influence the introduction and acceptance of change, but also with investigating how they interact with each other over time.

Understanding the processes of change requires a knowledge of internal politics and of the levers that organizations use to shift themselves from one socio-technical state to another. Jones has described these as **linkages**. He identifies four of these:

1) Enabling linkages such as processes, relationships, resources and controls, that assist the organization to change.

2) Functional linkages—factors in the environment of the organization that facilitate its changing.

3) Normative linkages—norms and values that assist the change process, and

4) Diffused linkages—informal systems and communications that also contribute to changing.[6]

Research into the processes of change requires time. It has to be longitudinal. This makes it expensive and laborious. The researcher has to have close contact with the research situation over a considerable period of time, either continually or by returning at frequent intervals.

It is in relation to the processes of change that action research has been most used. The researcher is now no longer an observer. She or he is helping the organization to develop and carry out strategies for change, with the researcher evaluating the success of these and feeding back insights and knowledge to the participants in the change situation.

Studies of the processes of change are concerned with problem identification, design, implementation, operation and evaluation. They examine how societies, or organizations, or groups or individuals shift themselves from a pre-change state A to a new, post-change state B. In an action role the researcher has to work with engineers, systems designers and managers—an interdisciplinary association cannot be avoided.

Change of this kind is a highly political process. There will be many stakeholders, all with different and often conflicting interests. In either an action or an observer role the researcher has to establish good relationships with all of these and can usefully involve them in the research. Their interest and cooperation can help the researcher make sense of a complex and dynamic situation.

ORGANIZATIONAL AND TECHNICAL DESIGN

There is always a design task associated with the introduction of information technology. The problem up to now has been that it has often been defined solely as a technical design task. The need for complementary organizational design has either not been perceived, or there has been an assumption that human organizations will adjust naturally and spontaneously to the requirements of a new technical system.

Yet there is little doubt that information technology, to work effectively, must be associated with an organizational structure that fits easily with it. The Tavistock Institute in London developed the notion of **joint optimization**. Systems must be designed so that both the technical and the human parts are working as close to their optimal level of effectiveness as is possible.

Researchers are interested in how this design task is defined and carried out and in the consequences of this process. As action researchers they are interested in contributing to good design.

It can be argued that the researchers' mission of assisting prosperity, while creating high quality work and non-work environments which provide human satisfaction, must be kept firmly in the forefront of this research. It provides evaluation criteria against which to judge current practice. It also provides action researchers with an ethical strategy. Communities and organizations should not be designed to fit technology, they should be designed to fit social and business requirements and human needs, with technology a contributary means to the achievement of these.

MAINTAINING SYSTEMS VIABILITY THROUGH ADAPTATION

This research area focuses on how communities and organizations survive through their ability to constantly respond to environmental pressures, or, if they are powerful enough, to exert influence on the environment in which they operate. Contingency theory addresses this subject area, although without providing much help to the practicing politician or manager.

Systems designers know that they must develop adaptive and flexible systems which can respond to today's volatile environments. But they have the difficult problem of not knowing the exact nature of the pressures which will impact on their systems. Human beings, particularly managers, must now be able to adjust to constant change, and be able to manage this. This requires quite different skills and talents from those of the traditional manager.

The maintenance of systems viability applies to communities as much as organizations. Social problems arise from the stresses of technological unemployment, the loss of familiar skills and the strain of rapid change on a community. These are all important areas for research.

To sum up this section of the paper. The writer is suggesting that research in information technology needs to address four major issues.

1. It must be concerned with **total** not partial situations. It must be able to identify the key variables affecting change and the relationships between these variables, and not focus on single variables. In other words it must be contextual.

This requires **application centered**, interdisciplinary research.

2. It must pay particular attention to the 'processes of changing,' both in terms of theory and practice. Researchers working in this area will need social skill, political sensitivity, good access and requisite time. This research ideally needs to take place as change events are occurring. It should not be retrospective.

3. The third critical research area is that of organizational design. Design should not be directed at making industrial companies or communities fit information technology. It should be concerned with the realization of business and human missions and objectives; with technology designed and used so as to contribute to these.

Much work has already been done in this area although not in the context of today's technology. Also research has not yet addressed the problems of how advanced information technology affects management structures and specialist groups.

4. The fourth area is system viability and adaptation. We need to understand how organizations can learn to respond easily to continually changing environments and to influence these environments. Systems viability implies an ability to control and reduce unwanted disturbance and tension. It is concerned particularly with organizational and social problems arising from the use of technology.

Research in all of these four areas needs to be concurrent with events, multi-disciplinary, contextual, qualitative and quantitative. It will require considerable social skills in those who undertake it. It can be either detached and observational or action centered. But which ever approach is used, it must be sustained and deep, not quick and superficial. At the same time there must be fast and continuous feedback of results to managers and governments.

Whenever possible it should lead to improved practice and provide examples of this. The researcher should not be afraid of making normative recommendations. Here the German humanization of work program can once again be quoted:

> The goal of the program must be that of combining the humanization of work and innovation . . . . . Humanization programs aim to draft and test model solutions for incorporating new technologies in in-

plant organization and administration organization, which can be adopted by other firms or administrations, and to demonstrate the planning of workplaces and work content in accordance with human needs.[7]

WHAT ARE THE PROBLEMS ASSOCIATED WITH THIS RESEARCH APPROACH?

All research has its problems, both of content and methodology. What are the problems of associating the research approach and emphasis described above with information and behavioral science research into organizations and technology?

There are four difficulties that need to be overcome before this research can achieve practical and theoretical results. These are related to legitimacy, acceptibility, values and methods.

LEGITIMACY

First, studies of business organizations and their relationship with technology must be seen as important and legitimate. This subject is avoided by many information scientists because they see it as non-scientific and by behavioral scientists because they believe it is atheoretical, interdisciplinary and unlikely to assist their progress forward in the profession. Funding bodies are often discipline-centered and will fund single discipline research but not multi-disciplinary studies. This situation is changing through a recognition that the problems of integrating organizations and technology are complex and difficult and require the resources of many knowledge areas.

Information technology does not, of course, impact solely on industry and administration, it pervades the whole of our society. Nevertheless industrial studies are extremely important, and researchers have a great deal to offer here.

ACCEPTANCE

If researchers are willing to accept that their mission is to acquire knowledge to assist the prosperity of the country and the happiness and well being of its inhabitants, then they have to communicate this knowledge to managers, trade unions and workers in industry. So far, they have singly failed to do this successfully.

A great deal of knowledge on how to introduce technical change already exists. We now understand much about the processes that make change acceptable and unacceptable and we know how to design effective technical and organizational structures. The problem is how to communicate this knowledge to those in industry and government who can use it.

Somehow efforts must be made to bridge the gap between academics and their potential audiences. Here we come up against the difficulty of different, often conflicting, needs and expectations.

Roger Stuart, Principal of the British Rail Training Centre in London, describes these differences as:

- Academic's research is inclined towards theory, managers look towards practice.
- Academics are inclined towards the ideal, managers are oriented towards the real world.
- Academics tend to step out from experience, managers are required to pitch into action.
- Academics' work emphasizes dispassionate precision, managers operate in a world of feelings and messiness.[8]

In a Focus Paper published by the British Association of Teachers of Management, Mick Crews, as a practicing manager, gives his views on research:

> More good research, using a variety of research methods, conducted by different sorts of researchers, working with those who are in a position to apply research, is a *good thing* . . . . . attention should be given to issues which might give immediate benefit. This would probably include improving the understanding of managers of what research is, and what research is going on. Equally it would probably include improving the researcher's knowledge of what important issues managers would like researched.[9]

Here is an important problem which need research for its solution. The business schools are the educational institutions which communicate most with managers on a face-to-face basis yet in Britain their behavioral scientists have not secured a high level of managerial acceptance. Communication between academics and those who work in industry urgently needs to be improved and each group needs to be more accepting of the other.

VALUES AND METHODS

The third problem applies to the funding bodies and those who sit on their committees, and to Academic Boards. They need to become more open minded on the subject

of research approaches and methods. All methods that will shed light on a problem should be acceptable and accepted. When research is concerned with complex situations and processes it is inevitably problematic and needs to be addressed in different ways and from different directions. In the past there has been a belief amongst researchers that certain approaches were more acceptable than others, for example, the experiment or the survey over the case study, detached research over action research, quantitative research over qualitative research. Methods should be judged on their ability to produce knowledge in particular situations. This is not to say that there should be no evaluation of methods, but new criteria need to be developed.

Two further points need to be made about research and research methodology. It needs to be multidisciplinary and this must be across the social and physical sciences as well as across the social sciences. University departments need to start talking with each other and developing joint research applications. Sociologists need to become accustomed to working in teams with engineers and systems designers. Research also needs to be associated with a fast response system. It is no longer useful to carry out *after the event* research and communicate the research findings twelve months after the research has been completed. The world will have changed too much in that time for such results to have much value. Research needs to be on going and concurrent and feedback to be immediate. The researchers and those who wish to use the research findings needs to be in continuous communication.

FROM STRATEGY TO ACTION

Given the research mission, needs and problems described in the previous sections, what kind of a research strategy will be most effective and contribute best to the requirements of researchers, funding bodies and those members of industry and society who have participated in the research. Here is what the writer would regard as an **ideal** strategy—something to be striven for, although not always achieved.

THE CHOICE OF WHAT TO RESEARCH

Ad hoc projects, focusing on single or small numbers of variables, would seem to be relatively useless. Knowledge is then produced in an uncoordinated manner and at present there are no mechanisms, apart from the occasional **state of the art** paper, to stitch it together. A better strategy is to focus on what can be called **essential** research topics. These are topics related to those aspects of change and changing which are common to all attempts to introduce information technology into organizations.

The four key research tasks described earlier in this paper fit with this notion of **essential** topics, and also with contextualism—examining the context in which the introduction and use of information technology takes place.

SETTING UP THE RESEARCH PROJECT

Earlier in this paper there was a discussion of the difficulties of communicating research findings to managers, or even arousing any interest in such findings. One way of arousing interest and commitment is by involving them in the design of the research project.

In the past behavioral and information scientists have frequently decided what research problem they wished to study and then gone out and sold this to companies. Less frequently, companies have identified their own problems and asked a behavioral or information scientist to come and investigate them. But whichever approach was used, the company usually left it to the researcher to organize and manage the research and often showed little interest in what was taking place.

A better strategy would be to ask for the active participation of management and trade unions in the design of the project. This can be done by setting up a Steering Committee and by having one or two key company individuals actively concerned with the project throughout its life. At an early stage agreement must be reached on what each party is seeking to achieve through the project. If the project requires the involvement of shop floor or office workers, then, ideally, they too must have representatives on the Steering Committee and be clear on what they can gain from the project. This approach is similar to what Mary Parker Follett called an *integrated solution*. Attempts are made to see that all stake holders gain something from participating and that there are no losers.

An example of this kind of participatory approach is the MIT Sloan School's *"Management in the Nineties"* research programme which is just starting up. Ten major U.S. and British companies are collaborating with the Sloan researchers in this project. At a seminar which the author of this paper was fortunate enough to attend academics and industrialists came together to do the following:

1. Establish agreement on the research questions that should be addressed.

2. Identify theories, knowledge and concepts which are relevant for each research question.

All subsequent activity will be jointly conceived and designed, and a steering committee drawn from researchers and participating companies will oversee the projects during their lives.

Where companies are unused to participating in this way, and perhaps reluctant to do so. Their interest can often be stimulated and maintained through the regular feedback of results, ideas and suggestions to interested groups and individuals. **Secret** research needs to be replaced by **open** research.

Today, research must have relevance for sponsors, for managers and for the clerks in offices and the technicians and operatives on the shop floor. It must also be of interest and value to the trade unions. This means a willingness to share the research task at every level from the design of questionnaires to the dissemination and discussion of the results. This presents a challenge for both academics and industry.

CARRYING OUT THE RESEARCH

It has been suggested that today's research should be concurrent and ongoing rather than historical. This approach again provides an opportunity for the involvement of those located in the research situation. There can be constant discussion of research strategies and results and their help can be sought in the analysis and understanding of these results. This approach was first tried by the writer when researching the introduction of shopfloor automation in a British automobile company—British Leyland. All the men working on the transfer line were interviewed about their attitudes to work and their job satisfaction. When these interviews were completed it became very clear to the researchers that they did not have an intimate enough knowledge of life on the shop floor to be able to interpret them with any accuracy. They therefore asked a small group of shop floor workers if they would help them with their analysis of the questionnaire data. This was extremely helpful to the researchers who realized that without this shop floor assistance many of their conclusions would have been incorrect.

Concurrent, ongoing research does not have to be totally subjective and unscientific, however. As new developments are introduced into the change program, hypotheses can be developed about the nature of their impact and careful records kept to test the correctness of these hypotheses. Sackman has made a plea for 'real time' research in which continuous measurements of a new system's effects are used to estimate and influence future systems's performance.[10]

The increasing popularity of **prototyping**—setting up small pilot situations to test out new technology—means that there is once again a possibility of experimentation, something which behavioral scientists seem to have moved away from in the immediate past.

This participative approach assists interests, cooperation and the application of results, but it is not easy for the researcher to manage. Just as researchers are now being asked to investigate organizational situations of considerable complexity, so they are being asked to manage a high level of complexity in their research task.

ENDING THE RESEARCH

At the end of a research project the researcher has to be able to withdraw gracefully, leaving behind good relations and a group within the company that has enjoyed the research experience and found the results useful and relevant. This requires a check that the objectives of all the groups involved in the project have to some extent been achieved. Have management, the trade unions, the shop floor and office workers and the researcher all got something of value from the research? How can this knowledge be effectively used to improve business prosperity and the quality of working life of employees?

The question of the publication of the results is now likely to be raised, although agreement on publishing should have been reached at the start of the project. Here a way of publicly stating the shared ownership of the research is through a joint publication. This gives the research credibility in the management part of the outside world, while it in no sense prevents the researcher from publishing her or his own articles in academic journals.

EVALUATION

This is something that neither industry nor researchers do very well. Companies introduce major technical projects at great expense but, once these are operational, they often fail to establish the nature and amount of the gains and losses that have occurred. As a result of this neglect there is less learning about how to manage change than there could be. Here is another area for cooperation between company and researcher. The company obtains useful knowledge, the researcher learns about the problems of evaluation and contributes to the improvement of methods.

The approach described in this section is put forward as a way of avoiding many of the problems which researchers experience at present, and as a viable means for handling the complex subject of technical change in the future. In particular, the participative nature of the approach should help solve the communication problems between researchers and the outside world which are now

experienced. It should also give research more legitimacy in the eyes of managers and governments.

CONCLUSIONS

Systems designed for people require a major input from those who will use them if they are to work effectively and be accepted. But they also require a knowledge of available technical and organizational options, and of the factors that affect and assist successful design and implementation. In a rapidly changing technical world this knowledge requires research and a new approach to research is required to acquire it. Without knowledge firms, facilitators, technologists and users will be designing in the dark.

As the German **Humanization of Work** program has been quoted in this paper, it is appropriate to end with a quotation from one of their publications:

> Innovation in the traditional sense means the development of new processes and products by means of the application of new technologies. This concept of innovation is, however, too narrow. Innovation is more than purely technical change. Innovation in the wider sense may be all the changes triggered by organizational, institutional and social stimuli . . . .New technologies, such as computer-aided production processes, information and communication technologies in offices, services and manufacturing offer opportunities for new qualifications, for new forms of work organization and for the liberation of man from technical constraints . . . . . Experience shows that it is characteristic of successful innovations that they incorporate technological, economic, organizational, social and human aspects.[11]

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